# Multidisciplinary Aspects of Learning Information Technology in Accredited Agricultural Education Programs

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*Abstract. During the transformation of the Hungarian Higher Education System new educational programs were developed on different levels in the agricultural higher education. The levels of the programs are Postsecondary, BSc, MSc and PhD programs. Most curricula required learning information technology on different content and level. These educational programs are accredited and the curricula are very similar in every university. The contents of the computing subject are almost the same on the BSc level. There are 15 BSc, 15 MSc programs in the Hungarian Higher Education System in 2009. The content of the informatics subject are the most important subtopics such as spread sheet and database handling, networking, etc. The professional subjects contain some informatics knowledge, but it depends on the educational program, subjects and professors. In the MSc programs the informatics topics differ by name and content according to the target of the training program. On this level more professional subjects can be found which contain applied informatics knowledge. But we think this is not enough in our education systems so we accredited the agricultural engineer in agricultural informatics and government BSc program. This program started 3 years ago and 5 Hungarian Universities offer this training program in 2009. The subject group of basic informatics has 36 credits and applied agricultural informatics subjects need 29 credits. It means that the rate of informatics and specialized informatics knowledge is more than 30% in the curriculum. The newest effort is that we have developed the Master of Business Informatics program with a "Informatics for Rural Development" specialization. The next development is a one year vocational training program in agricultural informatics. In the paper we discuss the demand of informatics knowledge on different educational levels and in programs based on the accredited training and outcome requirements as well as our training experiences.*

*Keywords. agriculture, education, information, technology, accreditation*

## Introduction

The Higher Education Systems are changing all over the world. The Hungarian Higher Education Act provided for the termination of the former dual (college/university level) training system, for the new linear higher education training system, as well as the conditions and procedures of establishing and launching training programs. Hungary - with the exception of artistic training - switched over to multi-cycle training, using the experiences gained from experimental training launched in 2004 and 2005 with the comprehensive launch of Bachelor programs in September 2006. During the first cycle, in the fields where experimental training commenced earlier (IT, engineering) the first students graduated in 2008; however, higher numbers of students are expected to finish their studies in 2009. The training program frameworks of the various programs are provided by the program completion and exit requirements, which are regularly published by the Ministerial Decree on the program completion and exit requirements of bachelor and master programs. Starting in 2009, the Master level training system will build as a phasing-out system on the Bachelor level training system launched comprehensively in September 2006. The preparation of Master level programs began after the commencement of the first training cycle. The earlier university and college level training system played a less significant role in the establishment of programs. However, higher education institutions in general strived to have a second cycle program built on the first cycle programs in every field. Professional university workshops also took the initiative, using their scientific background and personal conditions, to prepare special training programs aimed at narrower fields instead of more generalized programs (Csirik, 2008).

## The Centre for Agricultural Sciences at the University of Debrecen

The University of Debrecen, like many other integrated institutions of higher education in the country, was formed on January 1, 2000 by (re)uniting formerly independent institutions. Its historical roots reach back to the foundation of the Reformed College of Debrecen (1538), of which three academic sections later served as the base for the Hungarian Royal University of Sciences. Higher education in agriculture began in 1868, when the National Higher School of Agriculture was formed in Debrecen. The University of Debrecen having 19,000 full-time students out of a student body of 29,000, and having more than 1400

instructors is one of the largest higher educational institutions in Hungary. Its 15 faculties and 21 doctoral schools undoubtedly offer the widest choice of majors and other forms of training. The University has 3 Science Centres which are formed by faculties: Medical and Health Science Centre, Centre of Arts, Humanities and Sciences, Centre of Agricultural Sciences and Engineering.

**Centre for Agricultural Sciences and Engineering**

Agricultural higher education in Debrecen has a history spanning over almost 140 years. A major element of the international co-operative activities of the Centre of Agricultural Sciences and Engineering with 120 institutions in 30 countries is the mobility of students and teaching staff. Within the framework of the ERASMUS and CEEPUS programs, traineeships, the students can study in almost all countries of the European Union and with the help of international scholarships and agreements; they can travel to numerous countries of the world.

The Centre of Agricultural Sciences and Engineering has four doctoral schools (animal husbandry, crop production and horticultural sciences, agricultural and natural sciences, agricultural economics and rural development) embracing the fields of agricultural sciences, food, environmental and social sciences and rural development. The students and graduates travel to numerous universities and research institutes in the world, thereby, widening the existing diverse international relations. Since 1993, more than 100 doctoral degrees have been awarded by the four doctoral schools of the Centre.

The Centre for Agricultural Sciences and Engineering has 3 faculties and 3 research institutes and 1 extension centre. Faculty of Agricultural Economics and Rural Development, Faculty of Agriculture, Faculty of Engineering, Farm and Regional Research Institute, Karcag Research Institute, Nyíregyháza Research Centre , Northern Great Plain Regional Extension Centre

**Faculty of Agricultural Economics and Rural Development**

The mission of the Faculty of Agricultural Economics and Rural Development, founded on 1 September 2002, is to develop such high-quality educational, research and development activities in the region which meet the demands of the nation, the agricultural sphere of the economy and the EU integration process, and to contribute to the augmentation of national and international results via its creative activities. The Faculty, being one of the youngest units of the University of Debrecen, still preserves one of the oldest traditions of the Centre. The mission of the Faculty is to perform education and research in agribusiness and rural development with special focus on education in agribusiness, public administration, rural development and informatics.

According to the BSc-MSc system, the following BSc programs is launched: Agribusiness and Rural Development, Informatics and Public Administration, Finance and Accounting. The MBA postgraduate training (Entrepreneurial management further education program, International MBA, Agribusiness and Commerce major) is unique in Hungary, and it represents the highest level of business training in agribusiness.

**Faculty of Agriculture**

The Faculty trains experts at all levels of higher education in numerous fields of agricultural sciences: in addition to classical fields (animal husbandry, crop production, horticulture), environmental management, food processing, game management, nature conservation and waste management are also included among the diverse educational programs.

One level of this educational structure is represented by our four-semester post-secondary education programs: production and processing of medicinal plants and spices, waste management technician, horse-keeping, agricultural laboratory assistant, crop production and plant protection technician.

**Faculty of Engineering**

The College Faculty of Engineering has trained engineers, technical managers and engineering teachers for the economy since 1965. Most of the graduates find employment in the eastern part of the country, but graduates of the Faculty can be found in every part of Hungary. Within the traditional college-level programs and the new BSc programs in civil engineering, architecture, mechanical engineering, environmental engineering and technical management, the Faculty strives to provide its graduates with a special mentality and attitude in addition to up-to-date knowledge, which will enable them to lead creative life.

## Education Programs related to agricultural sciences

Looking back to 80s we started to teach computing subjects 30 years ago. After Introducing a few subjects we create specialization curriculum with applied oriented subjects (Herdon, 1997). During this period we developed more curricula and accredited education programs. The main milestones were the following on this path.

- 1987 Postgraduate Specialization on computing in agriculture
- 1995 Agricultural informatics specialization

- 2000 Business informatics specialization
- 2003 Agricultural informatics university degree education program
- 2005 Agricultural informatics and administration BSc program
- 2008 Informatics in rural development specialization in Business informatics MSc
- 2009 Planning new postgraduate program in agricultural informatics.

The Agricultural Studies Programs are multidisciplinary programs, that blend the contributions of a number of academic departments. The program develops during the Higher Education transformation process entitled "Bologna Process".

**Bachelor level training programs**

The Bachelor of Arts in Agricultural Studies programs encourage students to explore diverse approaches to agricultural production, distribution, and management in evolving economic and environmental settings. Experiential learning and applied research opportunities are offered through concentrations. University of Debrecen offers the following Bachelor programs in agricultural science and the student can graduate as an agricultural engineer.

- Animal breeding engineer
- Food engineer
- Horticulture
- Environmental management
- Agricultural engineer
- Crop production engineer
- Nature conservation
- Game management.
- Agricultural Economics and Rural Development.

In the first eight BSc programs student have to learn the informatics subject. The content of this subject is very general and doesn't contain application oriented sub-topics. We can say that there isn't multidisciplinary orientation in it. Students can learn some applied informatics, the so called applications in classical agriculture engineering subjects. The contents of the informatics subject arecomputing, networking, spread sheet handling etc.

The Agricultural Economics and Rural Development training program is different because the informatics subject has double material quantity than the other BSc programs. We built in different application oriented topics into the second part of this subject. The main important subtopics are agricultural information systems, geographical information systems and remote sensing, e-government and e-administration. These subtopics need knowledge in IT, economics, agronomy and law.

**MSc programs**

This year our university offers the following Master education programs

- Animal Breeding
- Horticultural
- Plant Protection
- Plant Production
- Rural Development
- Natural Protection.

The above mentioned MSc programs have one or more informatics subjects which are different. The contents differ according to the curriculum, they are oriented to the application area. For example in the Animal Breeding Master the 'informatics and Computing" subject has the following application oriented topics: Database systems and database management, Data models, modeling techniques, Objects in relational database systems, Geographical information systems, application areas. Applications of mathematics and statistics program packages. Another example is in the Rural Development program in which students have to learn an agricultural information systems subject. This subject contains the knowledge of the macro-information systems, such as price information system of the agricultural product, farm accountancy data network, the Hungarian and European Statistical (EUROSTAT) information systems etc. This subject is also a multidisciplinary one.

**The Doctoral Schools**

**The Doctoral School of Agricultural, Food and Horticulture Sciences** deals with the plant, soil, agro-climatology, agro-chemistry ,the analysis of crop production and pest management. Teachers and researchers worked together to provide a traditionally (and internationally) which is known as Crop Science Debrecen school. The two doctoral programs are: Sustainable crop production, Food Analytics and Food Safety.

**The Doctoral School of Animal Sciences** entitled "Regional resources based on environmentally-friendly livestock farming" research themes of doctoral students is closely linked to the Animal Science Institute's scientific activities, such as the pilot sites work, as well as the most current animal husbandry, Grassland covers the research areas in the region of Great Plane.

These two Doctoral Schools have an informatics subject (2 credit): The content of the informatics subject is the following:

- Information technology in agriculture
- Databases, Database Management Systems
- GIS, remote sensing
- Computer Networks
- Internet, Internet services
- WWW
- Research works: - Database creation tasks - to develop your own Web site – Studies on Agricultural informatics publications in relation to their own PhD research topic.

**The Business and Management Doctoral School** deals with agribusiness, but the School is moving towards general business and management science direction. The research areas are the following: the wider macro-and micro-agribusiness, and rural development-related issues. It has an Information management subject (2 credit) and the content of it is the following:

- System and information theory
- The organization and information systems
- Information management concept
- The information management tools
- Data and database management systems, data mining
- IT Infrastructure
- Corporate information systems
- Management information systems, business intelligence
- Data and information management on the Internet
- The information technology application in agribusiness
- Information systems in agriculture

## Specializations on informatics

The agricultural informatics university level training program was introduced into the Hungarian Higher Education system in the 2003/2004 academic year (Herdon at. al, 2003). Students started their studies in three sequent years in the University of Debrecen. Our five year experience confirms the aims, so 50% of the first students finished their studies in the 2007/2008 academic year. Based on our experience we developed a new BSc program, called „Informatics in agricultural administration" which started in 4 universities. Although the officers in the Ministry of Agricultural and Rural Development and other professionals expressed the demand for such training programs and experts the supported intake remains low. The facilities of graduated students to continue their studies on master level are not clear yet. The best solution could be a master similar to the former university level program. Another option could be a specialization in the Business Informatics Master program accredited by the Faculty of Informatics.

**Specialization in five year training program**

Based on our experience and demands the development of the curriculum was started in 2000 coordinated by the Department of Business and Agricultural Informatics. The curriculum consists of three main parts: informatics, agricultural economics and engineering knowledge complemented by general knowledge (human, social, language, etc.).

The aim of the university level training is to train experts for developing and managing informatics systems related to agricultural and linked area in the knowledge based information society. The graduates have to be able to understand the real production, operation and business model and they have to be able to make information models, to develop the informatics systems and run them. They can solve the problems related to informatics and information system with rapid developing and changing computing and telecommunication tools. The ability of modeling and creating or finding the suitable solver algorithms is also necessary. An important objective is that the professionals can understand the agricultural, economic and administration flows supported by informatics systems and can corporate with experts of other area. The university level degree course takes 5 academic years, the necessary total learning time are 9000 hours (with 3000 contact lesson hours) and the necessary credits are 300.

The rates of subject groups are the following (Figure. 1.):

*a. General knowledge*: It gives general knowledge about social sciences (philosophy, agro-sociology), law, environmental knowledge, mathematics.

*b. Agronomy knowledge:* The features of the training determine the necessary knowledge in agronomy. The main subjects are the following: Agricultural Zoology, Agricultural Botany, Agricultural Chemistry, Fundamentals of Agriculture and Food Industry, Basics of Soil Science, Natural Resources, Technology, Land Usage, Turf Management, Water and Environment Management, Nursery, Animal Husbandry, Plant Breeding, Animal Physiology and Hygiene, Plant Protection.

*c. Economics and related subjects:* Macro and micro economics, agricultural economics, farm management, accounting, marketing, financial, organization and management belong to this group of subjects. This knowledge establishes using informatics in agriculture and rural development.

*d. Informatics and specialized informatics knowledge.* This gives convertible informatics knowledge which can be used in different areas in agriculture and rural development.

*e. Other knowledge: Students can learn subjects in other training in our or other university.*

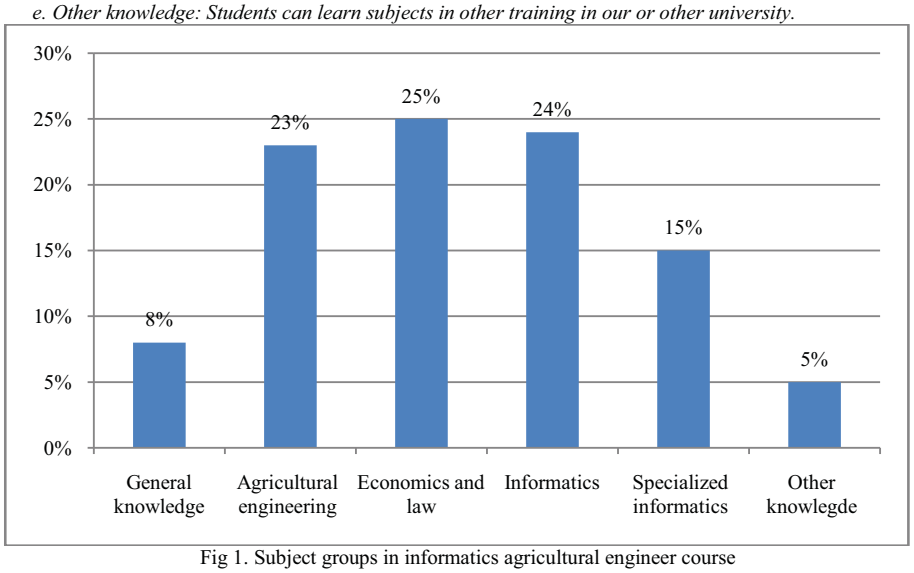


Fig 1. Subject groups in informatics agricultural engineer course

This course is unique in the Hungarian Higher Education System. When we started our program there was a reducing process of courses by the Ministry of Education. So we got only a reduced number of students. We had 30 students with state grant and 20 students with fees. But other universities are interested in similar training too. They can't introduce this training because of the Bologna reform process. We hope that the possibilities will be given in the new educational system.

**The new BSc training program**

In Hungary 3 universities, the University of Debrecen, Budapest Corvinus University and Szent István University have developed a BSc curriculum, namely an 'agricultural engineer for informatics and administration'. In the training students have to get 180 credits. The rates of the credits among the main subject groups are the following: General knowledge 18%, Agronomy knowledge 13%, Public Administration 12%, Economics and related subjects, 15%, Informatics and specialized informatics knowledge 42%. We would like to introduce this training in the 2006/2007 academic year.

The credit belongs to the main different groups of subjects:

- General knowledge: 28 credits
- Agronomy: 21 credits
- Public administration: 18 credits
- Economics and related subjects: 24 credits
- Informatics knowledge: 36 credits
- Special subjects: 29 credits)

The rates of the main subject groups are shown on Figure 2.

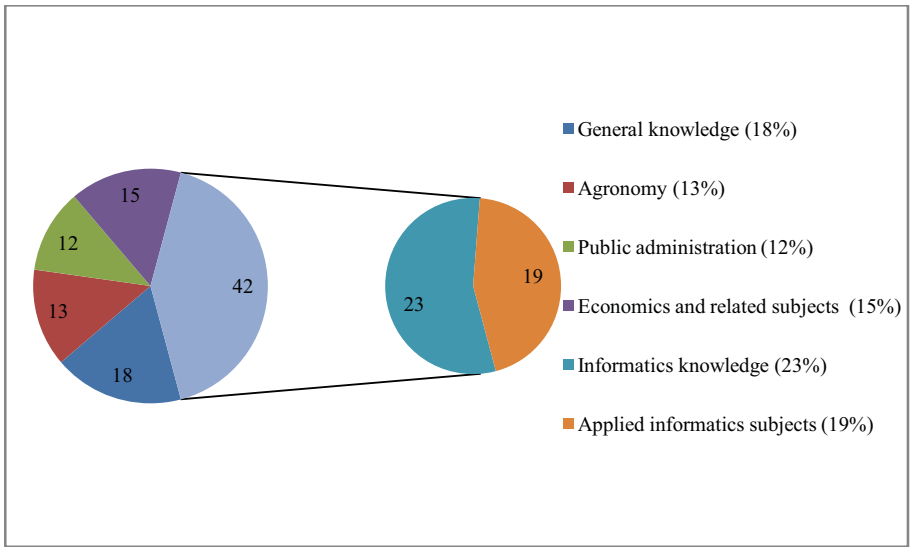


Figure 2. The rate of main subject groups in the Informatics and public agricultural administration studies

On this course there are two specializations (two training directions) in the 3 academic years. Students can learn specialized knowledge in the public administration and informatics. In the informatics specialization they can learn the following subjects: Agricultural information systems: FADN, IACS, Market Information Systems, Statistical System; Internet application development; Information management; Management and organization; IT in food quality management; Management information systems; Expert systems; Project management; Remote sensing; Sector specific solutions. Other subject that can be chosen by students free have 9 credits and the value of thesis is 15 credits.

**Business informatics MSc with IT in Rural Development specialization**

The the rural and agriculture development needs this training , to increase the innovative capability, the efficiency of management, business, association, regional, and specialized levels of management at the similar level seen in the industry (Nábrádi, 2007). The various branch issues, such as food quality, product monitoring, logistics systems, the development of rural areas, the spread of electronic business systems, the necessary services, the biological and technical data and development of knowledge, can't work without the appropriate use of information technology, economic and agricultural knowledge of the existence of professionals who are capable of information systems development and operation of the creative, participation. In the e-government, e-business, agricultural engineering, environmental protection areas, as well as agricultural management and information systems-specific technologies have been and are increasingly used in practice. The new functions and systems of knowledge and utilization of such knowledge is essential for the rural areas, agriculture and the closely related sectors (Csótó and Herdon, 2008).The Business informatics Master accredited by the Faculty of Informatics cooperating with the Faculty of Economics, the Faculty of Law and the Faculty of Agricultural Economics and Rural Development. The main content of the accredited MSc program is the following.

1. Expansion of the knowledge acquired at undergraduate, Master's degree required for initial topics:
   - Basic science (8-10 credits) advanced mathematics and computer science chapters (especially those with economic solutions to the mathematical methods, operation, simulation, mathematical statistics);
   - Economic and human knowledge (10-20 credits): Business and economics, corporate economics, legal, institutional, organizational and management skills, and knowledge of management accounting and controlling aspects of the intelligent information technology solutions for research, development required;
2. The professional core binding topics (20-25 credits): business modeling, expert systems, decision support, business continuity planning, IT systems development, planning, knowledge, data and knowledge management, modeling of formal languages, information technology strategy

planning, project planning and management, development of standard solutions, IT systems, re-integrated adaptation of management systems, electronic and mobile business, business application of web technologies;

3. The professional core must be chosen topics (55-80 credits, differentiated professional skills): On the IT in rural development specialization the obligatory and optional subjects are the following:

Obligatory subjects:

- GIS / Remote sensing
- Decision support systems for agriculture
- Specialized systems and information systems in agriculture
- e-Business models and architectures
- Rural economics.

Optional subjects:

- Integrated information systems in practice
- Advanced Microeconomics
- Food quality assurance systems.

## Conclusion

The University of Debrecen, Hungary has already 30 year old experience in agricultural computing, informatics training. It has been continually changed in various accredited training curricula which have been developed and introduced. They have been introduced with a lot of difficulties but they have been a success. The university was the unique who introduced the IT in agricultural engineering training program in the country. 5 universities have introduced the new BSc. The current barriers, the economic informatics MSc with IT in rural development specialization may be appropriate as an intermediate solution. However, the MSc educational system is only now emerging, but we hope to succeed in implementation of an appropriate and useful training program.

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